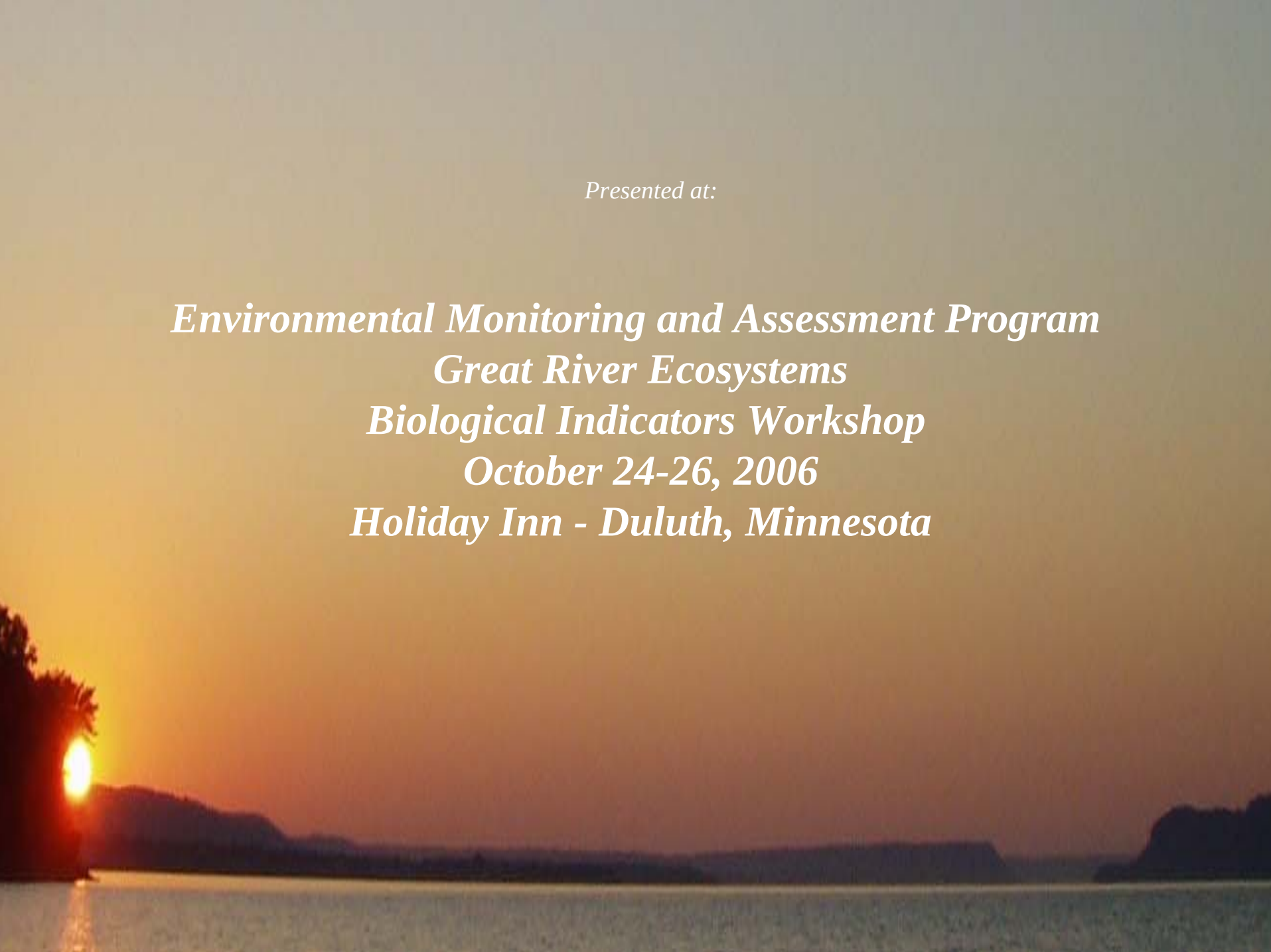
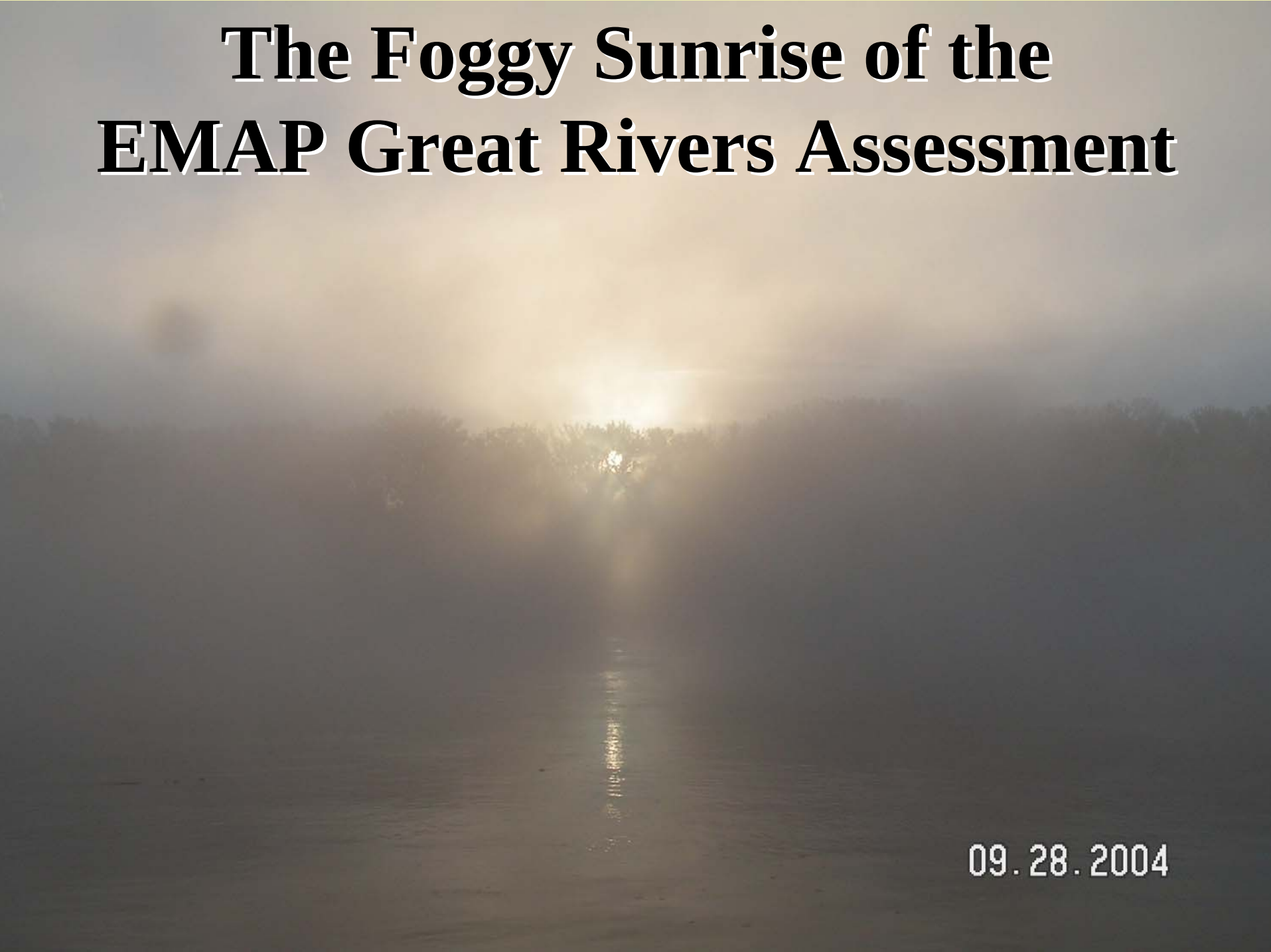


Presented at:

Environmental Monitoring and Assessment Program
Great River Ecosystems
Biological Indicators Workshop
October 24-26, 2006
Holiday Inn - Duluth, Minnesota

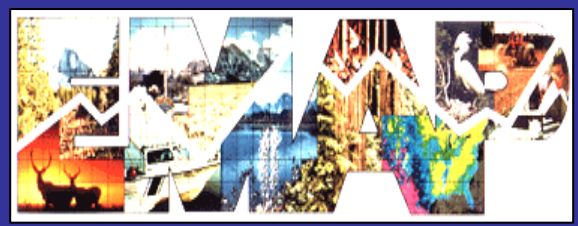
The Foggy Sunrise of the EMAP Great Rivers Assessment



The Ecological Assessment of the Upper Mississippi, Missouri, and Ohio Rivers

David Bolgrien

US EPA Office of Research and Development
Mid-Continent Ecology Division
National Health and Environmental Effects Research Laboratory
Duluth, MN



EMAP-GRE Indicator Workshop in Duluth, Oct 24, 2006

Quick EMAP-GRE facts

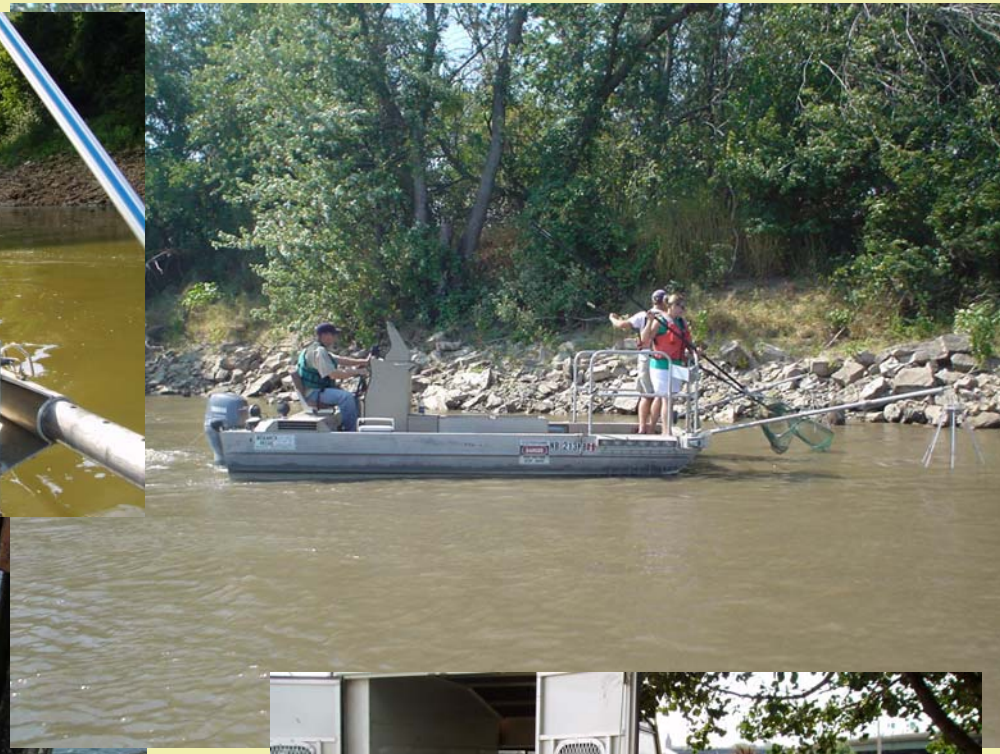
Our objective is to **develop, demonstrate, and transfer** bioassessment methods for Great River ecosystems.

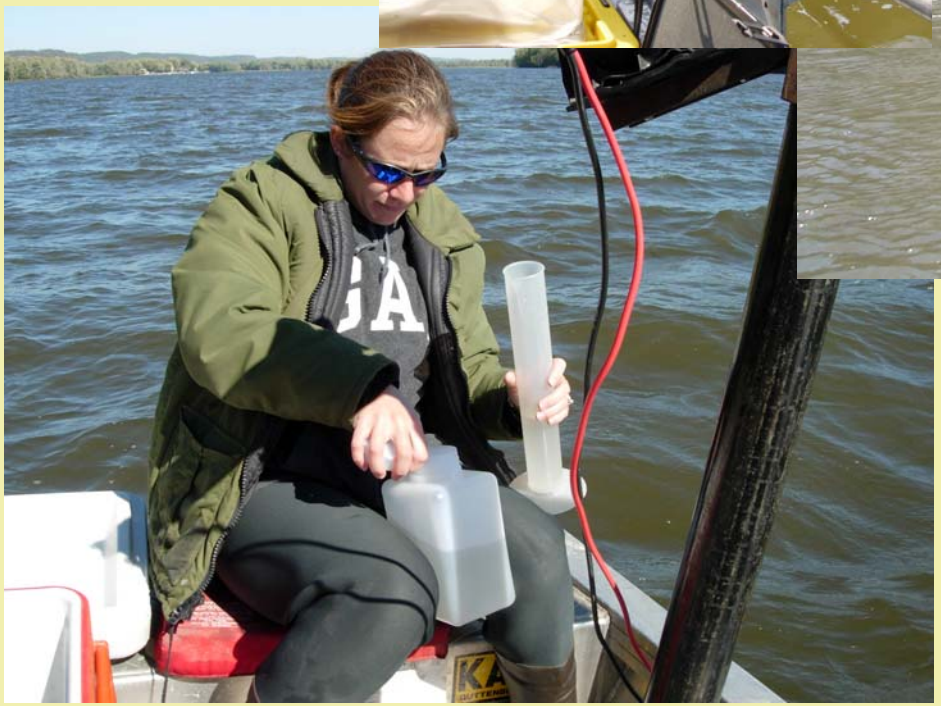
- July-Sept sampling in 2004-2006
- About 475 unique sites; probability-based design
- 10 crews; ≥100 people directly involved from about 15 agencies
- >8,000 samples processed
- Robust field methods for multiple indicators
- We have spent about $7M.
- Additional research being done on SAV, mussels, impairment diagnostics, methods comparisons, and water & biology assessment program integration

http://www.epa.gov/emap/greatriver

The Assessment will come from people…

…doing great things…

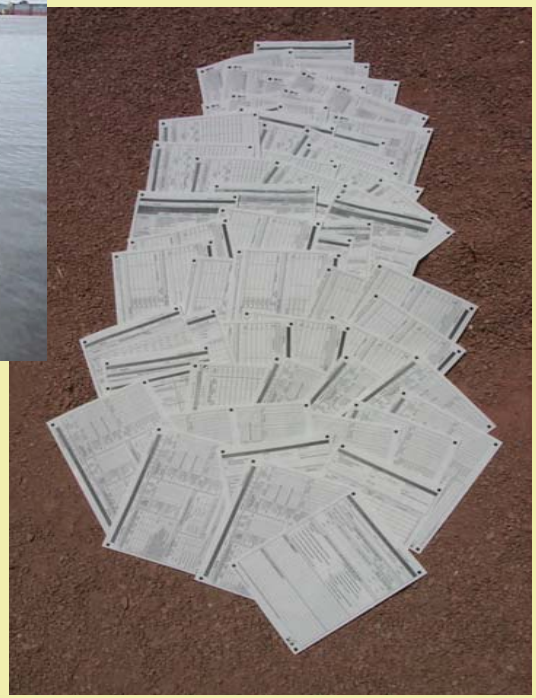




…to restore and maintain the chemical, physical, and biological integrity of America's Great Rivers.

From here

through here



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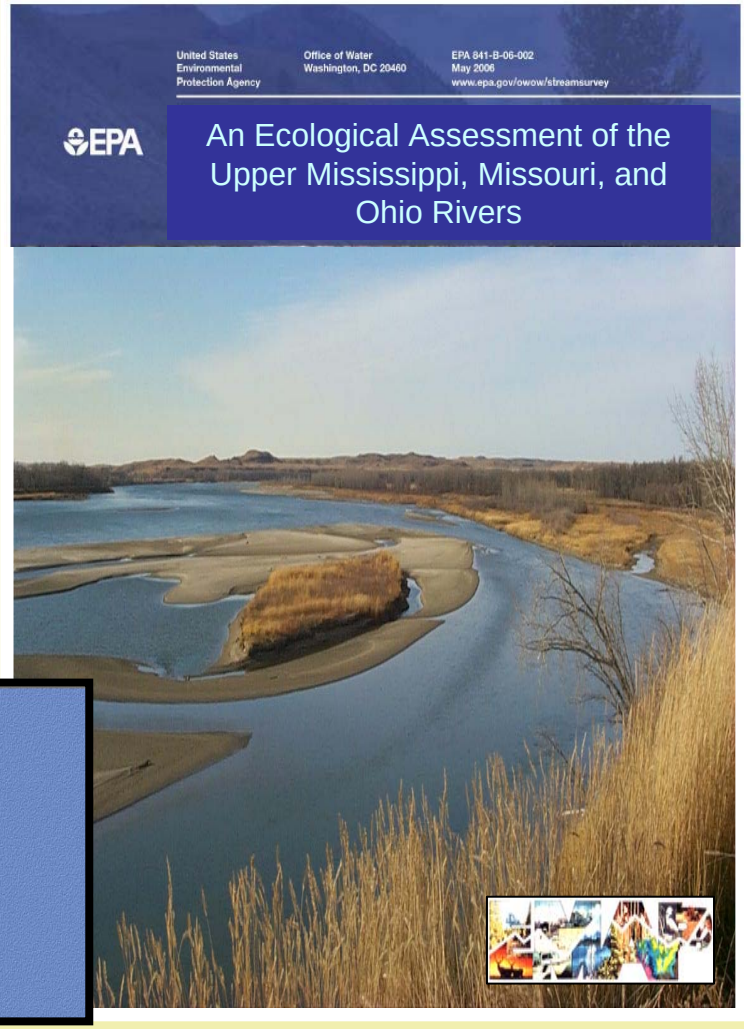
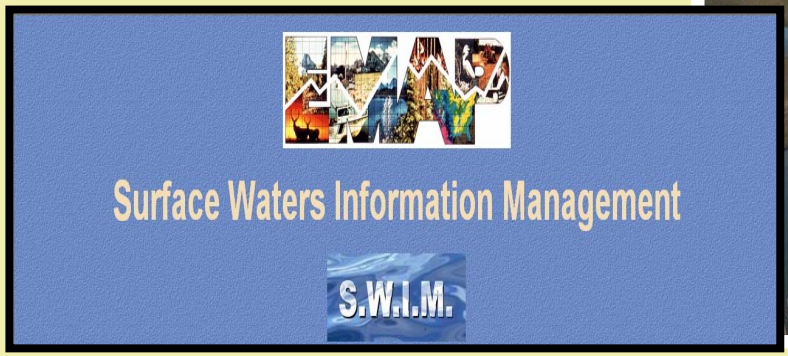




The EMAP-GRE Assessment Outline

Chapter 1 - Introduction
- The Clean Water Act and the need for Great River assessments
- Barriers to great river assessments
- Objectives of EMAP-GRE & Key assessment questions

Chapter 2- Design of the EMAP-GRE Assessment
- What are Great Rivers?
- Sample Frame / Reporting Units
- Sample sizes
- Assessment approach
  - Defining reference expectations and condition class thresholds

Chapter 3 - Indicators of Ecological Condition, Exposure, and Stress – Rationales and metrics
- Biotic assemblage indicators (Fish assemblages/ inverts / zooplankton / algae)
- Exposure indicators (Fish tissue contaminants & sediment toxicity)
- Water chemistry (Nutrients/ metals / other)
- Physical habitat indicators (Aquatic / riparian / littoral / Landscape)
- Process indicators (Sediment enzymes and geomarkers)
- Biological indicators of stress (selected alien and invasive species)

Chapter 4 - Assessment Results
- Assessment of condition using all indicators
  - Extent estimates of reporting unit
  - Summary assessment figures by reporting unit
  - Stressor extent by reporting unit
  - Relative risk estimates by reporting unit

Chapter 5 – Conclusions& Steps to incorporate approach into state programs and other river assessments
- Implementing EMAP-GRE on the Lower Mississippi River

Appendix - Design, Methods, and Analytical Procedures, QA, Information Management
- Reference condition approach (including condition-class thresholds used)
- Biotic index development approach
- Predictive models
- Human disturbance indices

Chapter 1: Introduction

The Clean Water Act and Great Rivers Assessments

It is not optional under the CWA.

EMAP has demonstrated approach. Results address needs.

EMAP-GRE fills basic science and data gaps.

EMAP-GRE is prerequisite for true national assessments.

Great River assessments must be a collaborative (read inter-state) and sustained efforts.

Challenges of assessing Great Rivers

Review concepts and approaches, including pros & cons of EMAP. For our objectives, the EMAP-GRE approach works.

EMAP-GRE Objectives

all together now!

Chapter 2: Design & Approach

What is a Great River?

A little academic, a little political, a little operational

Sample Frame / Reporting Units

Importance of standardizing frame and units.

Designed for States but will consider interstate reaches.

Differentiate between assessment and reference units.

Sample sizes

By state: MN 45, WI 56, IA 57, IL 85, MO 48

By section: MN/MN 9, MN/WI 36, WI/IA 20, IA/IL 37, IL/MO 48

Description of System

Hydrogeomorphic, climate, human development stage setting

Management objectives and history

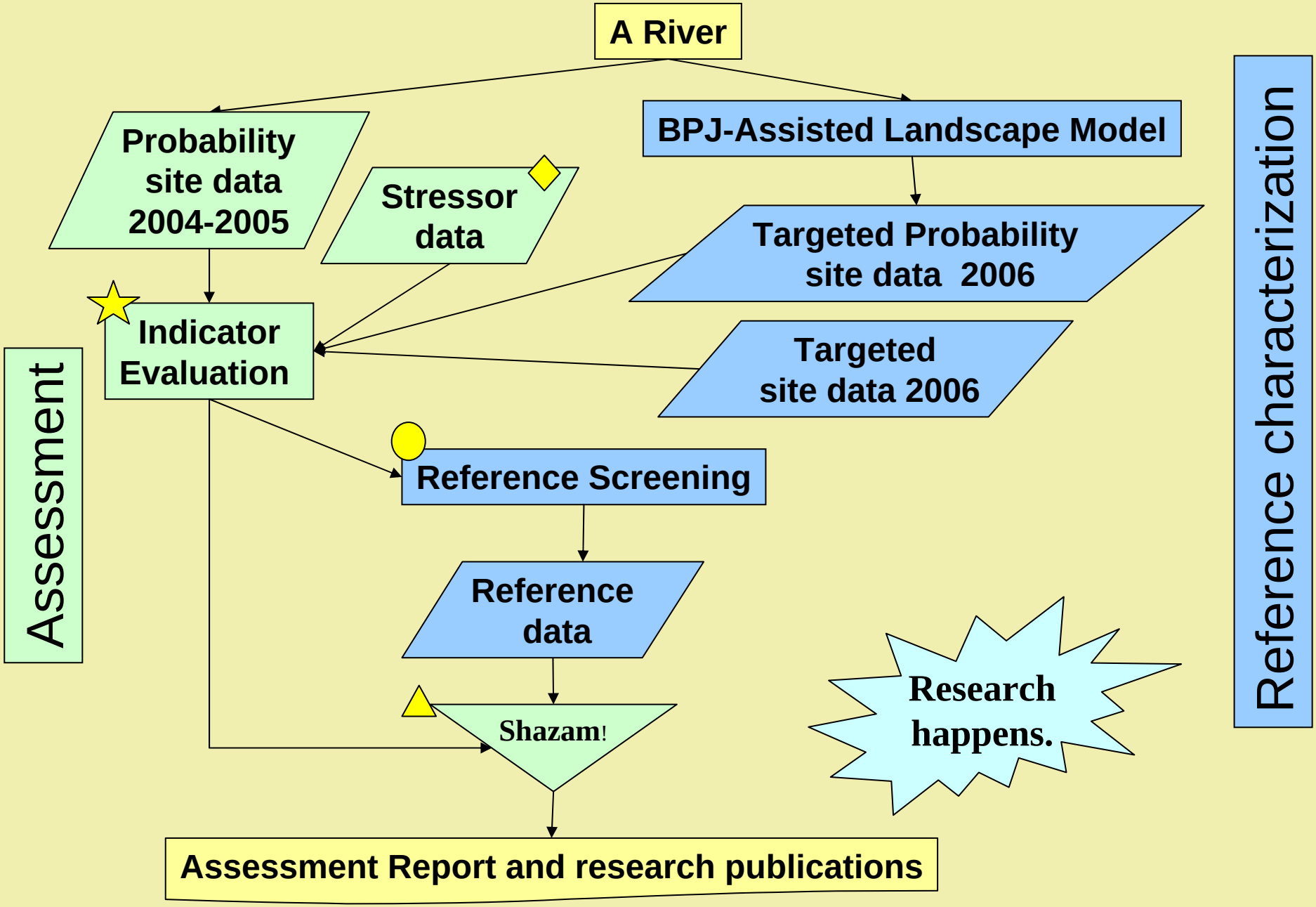
Assessment Approach *(most details will be in appendices)*

Response Design

Characterizing Reference Conditions

Explain reporting formats and estimation processes

Assessment Approach



Questions for the Breakout Sessions.

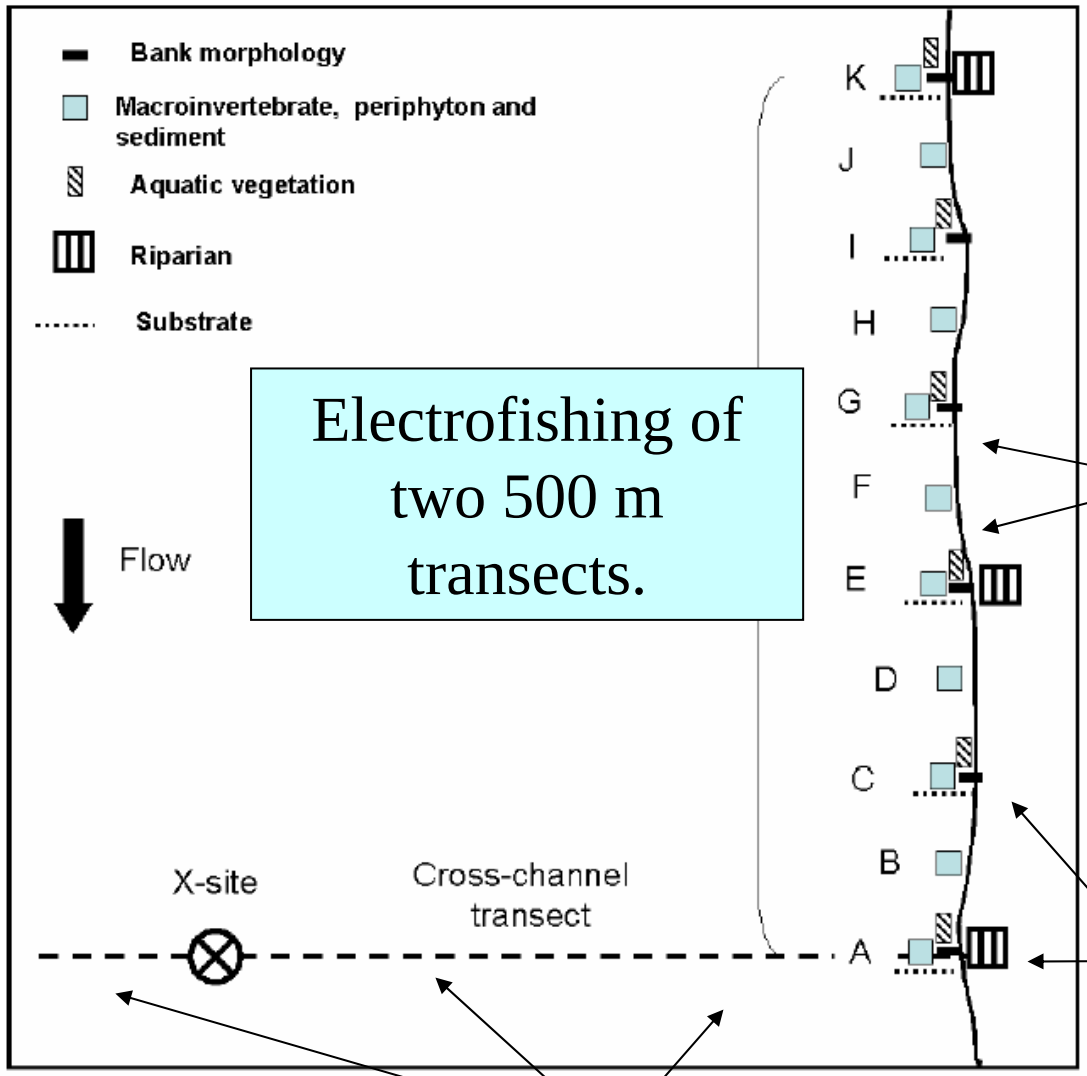
- What are the candidate metrics for your indicator?
- What is the status of your autoecology file?
- What are the barriers to assessment using each indicator?
  - Blocksum, Reavie, Bukavechas,

- How will stressor data be integrated into indicator development?
  - Moffett, Lazorchak, Jicha, Taylor

- Assessment outputs & Models
  - VanSickle

- Reference Condition
  - Angradi

EMAP-GRE field methods



Electrofishing of two 500 m transects.

Composite samples of benthos, sediment, and periphyton, and habitat data collected at 50 m intervals.

Aquatic and riparian vegetation, and bank morphology data collected at 100 m intervals.

Composite samples for water chemistry, phytoplankton, zooplankton, turbidity.

Dot-map showing sites from St. Paul to Cairo,
Pittsburg to Cairo, and Fort Peck to St Louis

Other maps of assessment units and physical geography.

Chapter 3: Indicators of Condition, Exposure, and Stress

Biotic condition indicators

Fish / benthic macroinvertebrates / zooplankton / phytoplankton / periphyton

Indices of Biotic Integrity (IBIs)

O/E (index of taxa loss)

Exposure indicators

Fish tissue contaminants & sediment toxicity

Water chemistry (Condition and Stress Indicators)

Nutrients / metals / others

Physical habitat indicators of Stress

Aquatic / riparian / littoral / landscape

Process indicators

Sediment enzymes activity

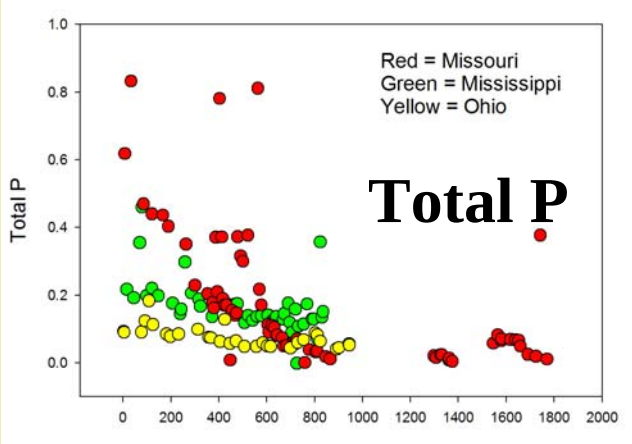
Biological indicators of stress

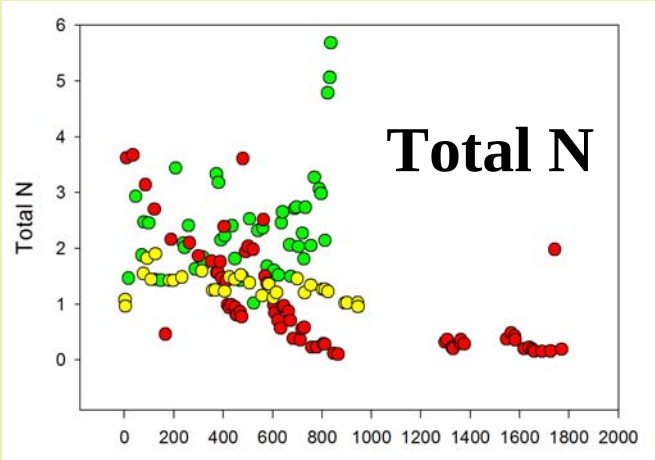
selected alien and invasive species

Disturbances beget stressors

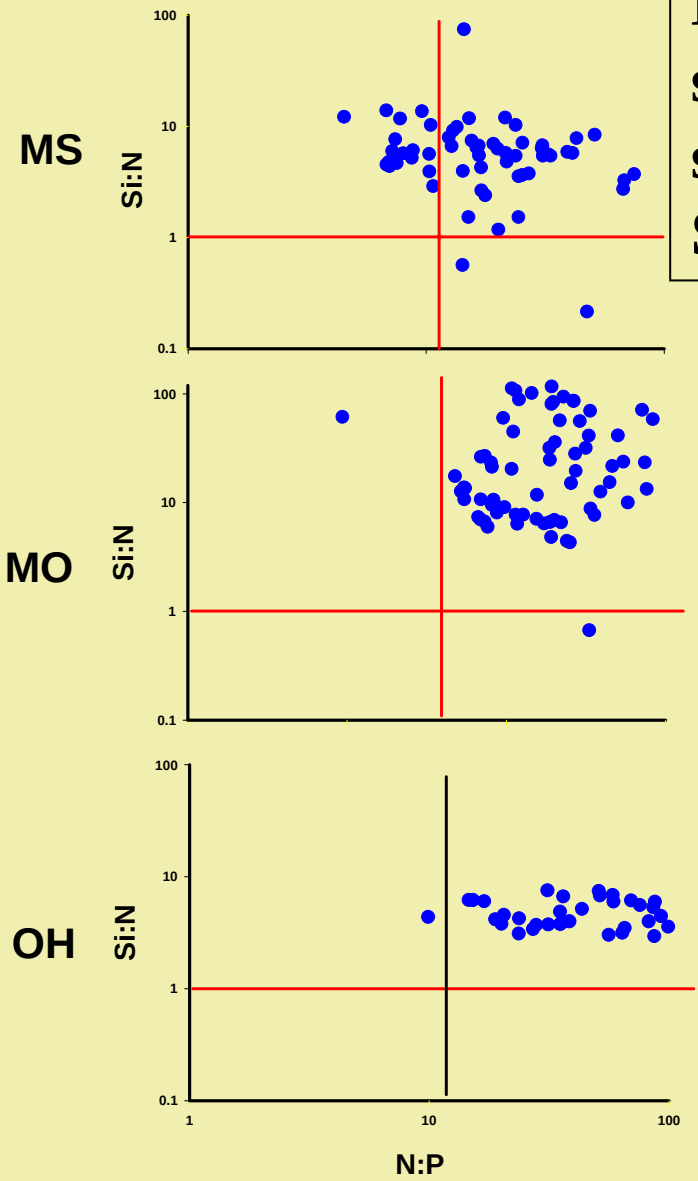
For assessments, they must be identifiable, quantifiable, and relevant to biota.

Chemical stressors





Contaminants



Nutrient ratios suggest wide-spread N and SiO_2 enriched.

Others:
SO4
Cl
DO
Turbidity
Chl
Metals

Physical habitat stressors

Channel, shoreline, & in-river modifications (revetment, woody debris, scouring, stage changes, etc.)

Riparian & landscape modifications (development, land-use, distance to disturbances)

Biological Stressors

invasive species, non-native species

Ranking of Stressors

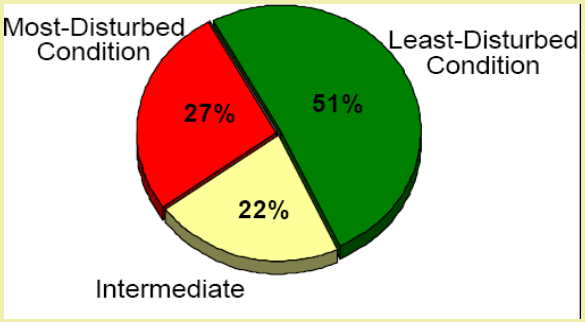
- **What is the prevalence of each stressor?**
  - **What is its extent (km of river in unit)?**
  - **How does its extent compare to other stressors?**
  - **Relative extent can be estimated from design.**
- **What is the severity of each stressor?**
  - **How much influence does it have on biota?**
  - **How does that compared to other stressors?**
  - **Can be estimated as Relative Risk.**

Chapter 4 – Assessment Results

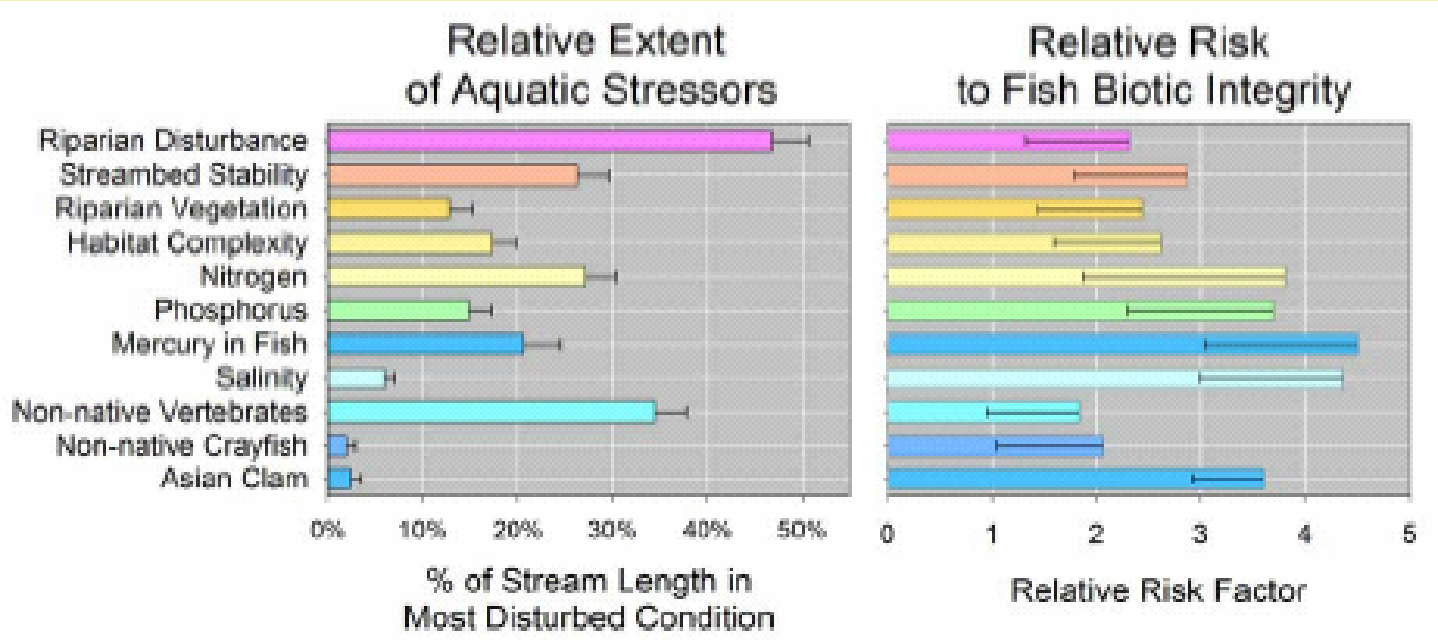
Condition extent estimates

What % (±error) of [resource] in [unit] is in [condition] as indicated by [indicator] ?

Resource	*Assessment Unit*	*Condition*	*Indicators*
Main-channel	State River inter-state units	Good Fair Poor	Biotic integrity Water Quality Stressors Habitat integrity
Challenges			
Relevancy Data limits	State buy-in Sample sizes	Reference conditions Biocriteria WQ standards	Variability & QA Metric selection & screening



Stressor extent estimates
Relative Risk estimates



Relative risk is a measure of severity of stressors on biology.
= 1 stress & biology not related
> 1 poor biology related to high stress

(from EMAP-W streams)

Chapter 5 – Conclusions

Describe condition of rivers with emphasis on biological indicators

Describe most widespread and significant stressors

Next Steps

- Incorporate EMAP-GRE data and approach into state programs (aka tech transfer).
- Assess the Lower Mississippi River
- Contribute to National River Assessments

Appendices: Design, Methods, Analytical Procedures, QA, IM, data dumps

- Sampling methods
- Quality Assurance
- Reference condition approach
  - condition-class thresholds used
  - Screening metrics and procedures
- Biotic index development approach
- Predictive models
- Hydrological indices
- Physical Habitat indices
- Human disturbance indices
- Site data (selected variables)

Timeline and bigger picture

- Phase 1: Assessment of the Upper MS, OH, MO Rivers.
  - 2008 Reports/papers on design and indicators for river assessments
  - 2009 Assessment Report
- Phase 2: Assessment of the Lower Mississippi River
  - 2007-2009 Develop design, refine methods, and do field sampling
- Phase 3: Research products and a synthesis report on the assessment of Great River ecosystems (2007-2015)

	FY06	FY07	FY08	FY09	FY10	FY11	FY12
Coastal	Lab,data	Report	Research	Design	Field	Lab,data	Report
Streams	Report	Research	Design	Field	Lab,data	Report*	Research
Lakes/ Reservoirs	Design	Field	Lab,data	Report	Research	Design	Field
Rivers	Research	Design	Field	Lab,data	Report*	Research	Design
Wetlands	Research	Research	Research	Research	Design	Field	Lab,data

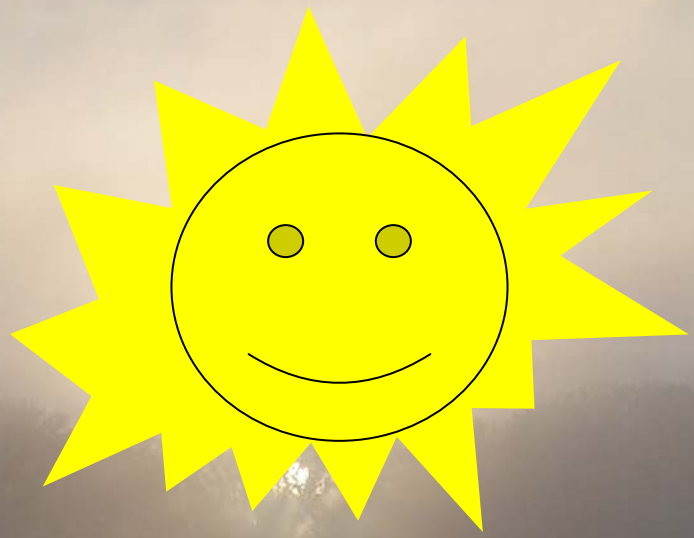
Phase next: Contribute to OW's National Assessments

National Assessments highlights

- Motivated by States' needs for more & better assessment data and to evaluate effectiveness of programs.
- Goal is to characterize water quality and biology at regional & national scales using consistent methods, designs, and indicators with regionalized reference conditions.
- "New" funds to improve States' monitoring programs
- "New" funds to conduct EMAP-like surveys
  - Repeat assessments every 5 years

Have a Good Day!

Do not stare into the sun.



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